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Dominance in domestic dogs - a response to Schilder et al. (2014)

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Abstract

We here respond to the claim by Schilder and colleagues (Schilder, M. B. H., Vinke, C. M., van der Borg, J. A. M., 2014. Dominance in domestic dogs revisited: Useful habit and useful construct? J. Vet. Behav.: Clin. App. Res. 9, 184-191) that dominance is a useful construct in the interpretation of companion dog behavior. We first make the distinction between the well-established use of the dominance framework in the ethology of wild species, and its more contentious use in the domestic dog as a character trait and as a descriptor of motivation. By evaluating recent studies of canine "personality" (individual differences in behavior that are consistent across time and context), we conclude that there is no evidence that dominance is a character trait of individual dogs, but rather that it is a property of relationships, that can arise due to asymmetries in any one of at least three distinct personality traits. We question whether concepts derived from wolf behavior have much utility in interpreting the behavior of domestic dogs, since recent studies of groups of free-ranging dogs confirm that the dog has lost three traits key to the social organization of the grey wolf, namely coordinated group hunting, reproductive suppression, and provisioning of cubs by non-reproducing relatives. We further question whether studies of free-ranging dogs, which routinely compete for physical resources, provide an appropriate framework for interpreting the behavior of companion dogs, which generally do not. We then reinterpret Schenkel's "active submission" posture as primarily affiliative and an indicator of the dependence of younger, inexperienced dogs on the older members of their social group. By reviewing the key literature on the cognitive abilities of domestic dogs and other social Carnivora, we demonstrate that the primate-based "Utrecht School" model of dominance makes assumptions that are invalid for domestic dogs, because the overwhelming balance of evidence indicates that relationships among social Carnivora are based on non-cognitive mechanisms. We conclude by examining the implications of Schilder and colleagues' model for the management of relationships between dogs and their owners.

Keywords: dominance; domestic dog; dog-human relationship; comparative cognition; animal personality

In this paper we discuss the arguments made by Schilder et al. (2014) disputing the position we set out in our paper "Dominance in domestic dogs - useful construct or bad habit?" (Bradshaw et al., 2009): we also modify some of the conclusions we made there in the light of studies published in the intervening period. We then extend our conclusions to address the behavior and management of companion dogs more specifically.

In our 2009 paper, we did not intend to criticize the use by ethologists of constructs such as "dominance" that conveniently summarize the flow of competitive interactions within groups of animals, although both Schilder et al. (2014) and Bonnani and Cafazzo (2014) appear to have assumed that we did. Without the statistical rigor that accompanies such analyses, it is difficult to make reliable comparisons between different studies, or between species, and accordingly they are a valuable tool for the ethologist interested in the adaptive nature of competition. Primarily, as stated in our Abstract (Bradshaw et al., 2009), we set out to challenge two widespread conceptions that underlie certain approaches to the management of the behavior of companion dogs: first, that "dominance" is an identifiable character trait, i.e. a property of individual dogs, and not (only) of relationships; and second that much of companion dog behavior can be explained in terms of a motivation to achieve "status", i.e. the right of access to all resources irrespective of their current or future value to the dog concerned. Bonnani and Cafazzo (2014) do not appear to address either of these issues, but Schilder et al. (2014) restate and attempt to justify both.

We regard it as essential to retain the distinction between the use of dominance as a conceptual framework by which ethologists can summarize their observations of competitive interactions within a social group, and its use in understanding and predicting the behavior of individual dogs, perhaps most crucially when diagnosing behavioral disorders and deciding upon methods for behavior modification. Put simply, although it is easy to detect an asymmetry in exchange of behavior between two dogs, we here propose that there is scant scientific evidence supporting the idea that the dogs are aware of that asymmetry (their "status") and even less that they are motivated to increase that "status" through the exchange of behavior. At the current state of our understanding of canine cognition (Bräuer, 2014) it is more parsimonious to assume that each dog simply reacts to the behavior of the other, based upon its previous experience of that dog's behavior, of similar behavior performed by other dogs, and the previous success (or otherwise) of its adoption of various behavioral strategies in similar previous situations. We suggest that this approach best explains the considerable variation in social relationships observed between domestic dogs, where only a

minority of dyads have an apparently fixed, unidirectional agonistic relationship, some have an inconsistent or context related relationship, and most interact repeatedly but rarely agonistically (Bradshaw et al., 2009; Trisko, 2011).

In their introduction, Schilder et al. (2014) highlight three recent studies as apparently confirming the concept of dominance as being applicable to domestic dogs. One (van der Borg et al., 2012; previously reported as Netto et al., 1993) is a brief conference abstract, which lacks essential details, for example the ethogram used, and the inter-relatedness of the group of dogs studied and its stability, so it is difficult for us to comment further. Trisko (2011) is a study of 24 neutered dogs interacting spontaneously at a "daycare" facility. From these interactions she was able to construct weak but inter-correlated hierarchies, based upon aggressive, dominant and submissive behavior patterns respectively, but such behavior formed only a small part of the interactions between the dogs. The third study, by Cafazzo et al. (2010), is the first and to date the only study that has demonstrated that the formal exercise of constructing dominance hierarchies can have utility in understanding group dynamics among domestic dogs, including "leadership" (*sensu* Bonanni et al., 2010) and reproductive success (Cafazzo et al., 2014).

Incorporating information from these and other studies published since 2009, we will here address five issues that appear to have led to misinterpretation of companion dog behavior.

1. Is dominance a personality trait in dogs?

In our previous paper (Bradshaw et al., 2009) we argued that the term "dominance" should be reserved for describing pairwise competitive relationships, and the vast majority of ethologists now use it in this sense only (Petherick, 2010). Even if "dominant" were an identifiable personality trait (a stable mental state that is predictive of behavior, see Miklósi et al., 2014), it would be confusing if the same word were to be used to describe both an absolute and a relative characteristic of the same animal: for example, a temperamentally "dominant" dog might be "dominated" by a slightly less "dominant" but much larger dog.

That "dominance", if it is to be used at all, should be reserved for relationships is confirmed by several recent quantitative studies of canine personality that have failed to identify "dominant" as a consistent dimension. As indicated by Schilder et al. (2014), some older studies did identify a "dominance/submission" dimension. Gosling and John (1999) cite several applying to primates, but only one (out of 4) refers to dogs, and in it "dominance" is combined with "territoriality" to produce a "protective" dimension (Coren, 1998). In their more extensive survey, Jones and Gosling (2005) identified 19 out of 47 studies of dogs that

included a dominance/submission dimension, but their classifications were made not statistically but by a panel of judges who may have been using different conceptions of "dominance", and also, by the authors' admission, have been biased by their own preconceptions of dog behavior.

None of the most extensively validated personality inventories for dogs based on owner descriptions has identified a "dominance" trait (C-BARQ, Hsu & Serpell 2003; revised-MCPQ, Ley et al. 2009; DPQ, Mirkó et al. 2012). For example, "Dominant" does appear as an item in the revised-MCPQ, but correlates with four other descriptors ("Nosey", "Opportunistic", "Proud" and "Thorough") to make up the subscale "Motivation" (Ley et al. 2009). This subscale is moderately positively correlated with Extraversion, weakly negatively correlated with Neuroticism (which combines "Sensitive" with "Cautious") and uncorrelated with Amicability (which includes "Unaggressive", and is therefore the inverse of the various aggressive traits identified in many other studies): thus no link emerges between "dominance" and aggression. Using behavioral testing of dogs, Svartberg et al. (2005) identified five personality traits: Playfulness, Chase-proneness, Curiosity/Fearlessness, Sociability and Aggressiveness - but not "dominance". Akos et al. (2014), cited by Schilder et al. (2014) do refer to a "unique personality" for "leader/dominant dogs", but had studied only 6 dogs, and moreover employed an unvalidated "dominance" index that is no longer in use (Miklósi, pers. comm.).

We therefore conclude that even if "dominance/submission" is useful to describe pairwise relationships between dogs, it is both confusing (semantically) and inaccurate (biologically) to also use "dominant" to describe a hypothetical personality trait. A dog might well appear to be "dominant" in a relationship when it scored higher than the other dog on "Motivation" on the revised-MCPQ (for example), but it might equally well appear to be "dominant" if it scored lower on either "Amicability" or "Neuroticism". Logically, an observed asymmetry in a relationship could arise from differences in one or more of several (so-called) personality traits, including but not restricted to that most closely identified with the word "dominant" by owners. Furthermore, and as also noted by Schilder et al. (2014), the personalities of two dogs do not always predict the emerging relationship between them: in our conception, such discrepancies can arise due to other asymmetries between the two animals, such as their different perceptions of the context of the interaction.

2. Are dominance hierarchies, when they can be detected, functionally comparable between wolves and free-ranging dogs?

Since our review (Bradshaw et al., 2009) a series of studies has been published of a single large pack of free-ranging dogs in Rome (Bonanni et al., 2010; Cafazzo et al., 2010, 2014) which demonstrate statistical links between dominance relationships (in the ethological sense), leadership and reproductive success. Bonnani and Cafazzo (2014) also report putative hierarchical structures in several other smaller dog packs, although the functional significance of these appears not to have been investigated in detail. The elaborate structure measured in the large pack may be unusual, since patchy and unpredictable distribution of resources usually forces free-ranging dogs to forage singly or in male-female pairs, and pack structure is usually fluid (Boitani et al., 2007; Majumder et al., 2014). Nevertheless, the Rome studies do indicate that apparently functional hierarchies can sometimes be observed in dog packs: it remains to be seen whether such correlations emerge from other free-ranging groups, and in particular whether "dominance status" is actually an adaptive trait in domestic dogs (see Bonanni and Cafazzo 2014 for discussion).

However, these apparent hierarchical structures need to be interpreted cautiously, not simply hailed as evidence that all dog behavior is homologous with wolf behavior. It is reasonable to assume that the exchanges of behavior that structure today's wolf packs are adaptive, or at least were adaptive over the millions of years of the evolution of canid sociality. It is also self-evident that many dogs perform many of the same behavior patterns that wolves employ for communication within their packs. However, this morphological similarity may be superficial and misleading, if the social context within which these signals are performed has been transformed by domestication, as appears to be the case from a comparison of groups of feral dogs with family-based wolf packs. These are quite different functionally, even though both may defend communal territories. First, such dogs are usually scavengers, whereas wolves can exploit large prey by hunting in groups. Second, wolf packs generally contain only one breeding pair assisted by their adult offspring from previous years which temporarily forgo reproduction themselves, while the mating system observed in feral dogs is promiscuous, such that most sexually mature members in feral dog groups attempt to breed each season. Third, wolf cubs are provisioned by both parents and by adult "helpers", while the puppies of free-ranging dogs are generally cared for only by their mothers, who may actively keep them away from other members of her group (see Cafazzo et al., 2014 pp. 10-11 for references).

Therefore we cannot be confident that any behavior pattern performed by one free-ranging dog towards another dog retains the function that it performs in wolf sociality. It is likely that as the social structures of proto-dogs altered to include humans as well as conspecifics, and also to take advantage of man-made environments, so the signaling requirements would have changed. Rather than develop new communicative behavior patterns, it would have

been evolutionarily parsimonious to adapt the meaning of existing canid signals to suit the new context. Thus apparently communicative behavior performed by domestic dogs may have evolved a different function during domestication, possibly to facilitate interspecific communication, or may even be a relic of wolf behavior that is no longer adaptive. Simply because a hierarchical structure can be measured in some dog packs does not mean that all dog behavior can be interpreted as if it were being performed by a wolf (and at that, in the traditional "wolf-pack" model, a captive wolf behaving in an unnatural way; see Mech, 2008).

3. Companion dogs do not have to compete, as feral dogs do

Free-ranging or feral dogs have to compete to stay alive and to leave offspring: companion dogs generally do not. The arguments put forward by Schilder et al. (2014) in support of the idea that all dogs strive for "status" appear to rest not only on the assumption that they are cognitively capable of doing so (see 5.), but also that because free-ranging dogs (apparently) strive for "status" using exchanges of aggression and formal dominance, so must pet dogs. Studies of interactions between pet dogs that could address this question are few, but two cited by Schilder et al. (2014) may be informative.

First, companion dogs often choose not to engage in any kind of competitive interaction even when given every opportunity to do so. Trisko (2011) reported that only 7% of the dyadic encounters that she recorded contained competitive elements, and even this may an over-estimate as she combined active submission (A-S, see below) with other submissive patterns, and not with affiliative patterns (which were: Nose Nudge, Muzzle Lick, Nuzzle/Rub On, Nibble, Genital Lick and Coat Lick). Affiliation with "submission" (i.e. probably primarily affiliation) accounted for 22%, two-way submission/affiliation 21%, and 50% no affiliation or submission. Moreover, mounting, a putative signal of "formal dominance" (Schilder et al., 2014), was not associated with aggression or any other kind of agonistic exchange. The overall conclusion of the study was that "Dogs use various combinations of agonism, affiliation and play to negotiate social relationships with other dogs" (Trisko, 2011, p. 79): in other words, "dominance" is certainly not the only, and probably not the main organizing factor behind relationships between pet dogs. Likewise, Bauer and Smuts (2007) were only able to assess the dominance status of 19 dyads out of 55, and 10 of these involved a single individual that was evidently highly competitive both within and outside the context of play. Arguably, if all pet dogs were primarily motivated by "status", this should emerge in signaling and/or actual aggression far more often than it evidently does.

This variation in social structures across studies of feral and companion dogs is consistent with the concept that social groupings develop not through a single organizing principle (i.e. "dominance") but are an accumulation of learnt dyadic relationships between individual pairs of dogs, and are based upon the net exchange of all types of behavior, including play and affiliation. Such relationships arise through a combination of individual personality characteristics, learnt experience specific to each individual, and cumulative learning from prior experience of the consequences of patterns of signaling. Hence, in groups where one individual has a particularly high 'Motivation' / low 'Neuroticism' / low 'Amicability' characteristic, and has cumulative prior experience of successfully achieving valued resources from others in the group, this dog will appear to be 'dominant' in interactions with all others. In groups where no individuals have such extreme personality characteristics, nor have learnt 'expectation' of success in interactions with others, outcomes of interactions are likely to be more variable, with no consistent overall structure.

4. Submissive-affiliative behavior is more correctly affiliative-submissive and is rarely a response to aggression

Several authors, including Bonnani and Cafazzo (2014) Schilder et al. (2014), and Smuts (2014) have emphasized that "dominance" is rarely a unitary construct, but can be broadly divided into two types of asymmetric relationships. One type is based upon aggression (threats, chasing, biting) to which the target animal responds either defensively, or "submissively", by retreating or adopting postures that indicate intention not to escalate the encounter, such as (in the case of dogs) looking away, and lowering the head and/or body. This broadly corresponds to the original "peck-order" concept of Schjelderupp-Ebbe (see Drews, 1993), and can arise whenever resources are disputed over, for example the aggression between male dogs over receptive females noted by Pal et al. (1999) and Cafazzo et al. (2010). The other, "formal dominance" (*sensu* van Hooff and Wensing, 1987) is based upon exchange of ritualized displays with no overt aggressive component (de Waal, 1989), such as (in free-ranging dogs: Cafazzo et al., 2010) an upright or stiff posture, placing the paw or muzzle on the other dog's back, tail held upright and wagging (all indicating "dominance") and "submissive-affiliative" behavior, comprising a slightly lowered posture with ears flattened, tail wagging below the horizontal, and, in its most complete form, licking the muzzle of the recipient.

"Formal dominance" is thought to evolve as a less costly version of the "peck-order", because it further reduces the risk of injury to both parties (Drews, 1993). In the dog pack studied by Cafazzo et al. (2010), "submissive-affiliative" behavior correlated significantly but rather

weakly with "submissive" behavior, suggesting that they may play different roles, at least at the dyadic level, in canine society. "Submissive-affiliative" behavior, although relatively uncommon, was entirely unidirectional, i.e. there were no reversals in any of the pairs in which it was recorded, and often "took place as an animal returned to the core area, or generally, when a dog joined the group again after a separation" (Cafazzo et al., 2010).

As such, "submissive-affiliative" or, as we suggest below "affiliative-submissive", behavior (A-S) appears to be homologous with "active submission" as described by Schenkel (1967) for the wolf. In naturally-composed wolf packs, A-S is performed spontaneously by the younger members of the pack, especially towards the breeding pair, who are usually their parents, and only exceptionally as a response to aggression or threat (Packard, 2003). It additionally forms part of the "greeting ceremony" when the pack re-assembles, when it may be performed by the parents to their offspring as well as vice-versa. It is also performed by companion dogs under similar circumstances (Bradshaw and Nott, 1995). Morphologically, it is self-evidently derived from the behavior whereby weanling wolf cubs stimulate regurgitation of food by their parents, and is therefore an obvious candidate for evolution of a ritualized display that acknowledges parenthood.

That this highly distinctive behavior pattern was ever labeled "submissive" could be regarded as an artifact of the circumstances under which it was first described, i.e. artificial "packs" of wolves with no kinship ties. Had David Mech's studies of free-ranging wolves (e.g. Mech, 1999) been conducted before those conducted in zoos, rather than half a century later, A-S might plausibly have been labeled affiliative from the outset, and its distortion into an aggression-deflecting signal in artificial confined packs would then have been recognized for what it is.

This interpretation also answers the following objection made by Schilder et al. (2014, p. 187) 'Explaining submissive actions as conflict defusing actions, instead of submissive ones, leaves the one-sidedness of the performance of submissive behaviors unexplained.' We do not conceive of A-S as primarily conflict-defusing, but as affiliation-building. Although the benefits that young adults accrue by staying within their natal packs are not easily quantifiable, and probably vary from one environment to another, they are likely to be substantial, otherwise it would be adaptive for them to leave (see Jennions and Macdonald, 1994, and Smith et al., 2012, for reviews). To their parents, adult offspring represent potential competition, both for immediate resources such as food, and as rival breeders. Due to the asymmetries of relatedness inherent in mammalian families (cf. maternal-infant conflict; Barrett and Dunbar, 1994), it pays young non-breeding adults to communicate their intention to stay in the pack and not to breed (hence the ritualization of an offspring-to-

parent signal: see Majolo, 2010 for our definition of “ritualization”), until such time as their same-sex parent comes to evaluate them as a net threat to his or her own reproductive success (see Mech and Cluff, 2010, for an example). Given the very different mating system of feral dogs compared to wolves, the accrued advantages of pack living may differ considerably: nevertheless, A-S has evidently been retained during domestication, possibly because it has been effective in forging amicable relationships between dogs and humans. The distribution of A-S in the data of Cafazzo et al. (2010) can plausibly be explained as the consequence of the following rule-of-thumb: “in order to be allowed to stay in the group, perform affiliative behavior towards all the members of the group older than you are”. The one-sidedness of A-S is therefore explainable by a combination of history and relatedness. All members of the group benefit from keeping the group together, but less experienced animals have more to gain than older, more experienced, animals.

5. Dominance can be explained without implying that it is a motivation.

The ethological definition of dominance, a consistent asymmetry in competitive encounters between pairs of animals, says nothing about the motivations or thought processes of the animals concerned. In computer models, not only individual dominance relationships but also hierarchies of varying linearity can emerge from quite simple, even stochastic, properties of the agents modeled (Chase et al., 2002). It has proved possible to build robots that establish convincing and stable dominance hierarchies, based on straightforward stimulus-and-response rules, and no "awareness" whatsoever (Vaughan et al., 2000; Funato et al., 2011).

Altmann (1981) proposed that cognitive experiences of dominance relationships were only plausible in higher primates and humans, and subsequent studies of the cognitive abilities of Carnivora other than wolves and domestic dogs have tended to confirm this distinction. Smith et al. (2012) state ‘Whereas both cognitive and non-cognitive (emotional and temperamental) factors promote cooperation and tolerance in living chimpanzees and humans .... all available evidence to date suggests that cooperation among extant carnivores is facilitated by noncognitive mechanisms’. Even apparently complex social phenomena, such as the “maternal rank inheritance” observed in spotted hyena clans, can be explained by associative learning (Engh et al., 2000). In domestic dogs, most investigations of social cognition have used humans as social partners rather than dogs, for ease of experimentation, but since dogs have evolved to cooperate with humans, it is likely that their cognitive abilities are no more sophisticated when dealing with members of their own species. To date, no conclusive evidence has emerged that dogs understand that humans have minds, or

313 comprehend the relationships that they have with humans (Bräuer, 2014): 'the evidence
314 suggests that dogs do not need to be readers of our minds; instead, they are exquisite readers
315 of our behavior' (Udell and Wynne, 2011). Thus non-primate mammals, including domestic
316 dogs, are unlikely to have any concept of the "hierarchy" that human observers can deduce
317 that they are part of, other than the individual pairwise relationships that they have with
318 other individuals. Their behavior can be entirely explained in terms of recognition of group
319 members as individuals and recall of previous encounters with those individuals, without
320 recourse to more complex cognitive mechanisms. The comparisons that Schilder et al.
321 (2014) make with primate social structures therefore need to be taken with considerable
322 caution: the underlying cognitive processes are qualitatively different.

323 Dogs self-evidently react to the behavior of other dogs, and it is easy to jump to the
324 conclusion that they conceive of other dogs (and indeed humans) as cognizant beings. Since
325 dogs appear not to have sufficient 'theory-of-mind' to do this (Bräuer, 2014), it is therefore
326 more parsimonious to assume that dogs' relationships with other dogs (and with people) are
327 built up progressively using associative learning, through the outcomes of successive
328 encounters. Escalation to the point of aggression may arise from any one of a large number
329 of factors, including the personality of the dog, the context, the perceived value of the
330 resource being disputed, the previous experiences of the dog with the other dog or, failing
331 that, generalization from encounters with similar dogs, and the effectiveness (or otherwise)
332 of signaling during previous similar encounters.

333 The consequences of presuming that dogs have a concept of "status" are not trivial for their
334 welfare: different notions of dogs' concepts of their own social interactions lead to very
335 different methods for treating problems arising from intra-specific and inter-specific
336 aggression, with those supporting physical (positive) punishment often justifying it as
337 "dominance reduction", based on the concept that dogs have a concept of hierarchy and will
338 only obey an "alpha leader" (Greenebaum, 2010). The use of aversive techniques can have a
339 negative impact on welfare (Schalke et al., 2007; Schilder and van der Borg, 2004) and can
340 also be dangerous to the person delivering the punishment, through elicitation of further
341 aggression (Schilder et al., 2014).

342

343 ## 6. Implications for dog-human interactions

344 Schilder et al. (2014) conclude with a discussion of the implications for dog-human
345 relationships of their assertions about intraspecific dominance between dogs. A fast-growing
346 body of research does indeed support the idea that dogs are uniquely sensitive to human

body-language (Topál et al., 2014), but Schilder et al. further claim that 'dogs are likely to interpret human postural information in terms of a dominance/submission relationship' (p. 189). However, they present no evidence to support this assertion, and the arguments made do not align with our (RAC and EJB) clinical experience, or those of authorities such as Luescher and Reisner (2008).

Schilder et al. (2014) claim that '(dominance/submission) explains why dogs that have an unclear rank relationship with their human partner are more likely to attack when the human partner shows a relatively "low posture"' (p. 190). If "low posture" is a sign of formal submission in dogs, as stated by van der Borg et al. (2012), then far from provoking the dog, its performance by the owner should *reduce* the probability that the dog attacks, because the signal should reinforce the dog's "desired" relationship.

They also claim that 'submissive status … chiefly necessitates an adequate socialization of the dog'. The converse of this statement would be that dominant status arises out of inadequate socialization. However, the processes involved in the so-called "socialization period include an inhibition of fear-based reactions towards unfamiliar social partners, and thus inadequate socialization increases the risk of fear-based behavioral disorders (Appleby et al., 2002), including aggression. Thus while thorough socialization is the essential basis for a harmonious dog-owner relationship, the rationale for connecting this with "dominance" is unclear.

Similarly, the assertion that preventing dominance requires a consistent response is also difficult to interpret. Consistency of interaction is widely thought to be an important aspect of human-dog interaction, enabling dogs to reliably predict how their owners will behave in different circumstances. Whilst inconsistency in owners appears to be associated with increased performance of anxiety and fear related behavior (Casey et al., 2007), it is not clear how inconsistency may influence "dominance" relationships.

Schilder et al. (2014) also deduce that 'attacks (that) occur in non-competitive contexts' must be motivated by the dog's desire to enhance its "status". In reality, it would be impossible to determine whether the context of an attack was "non-competitive" from the dog's perspective, since this would have to rely on the report of the human victim, who is unlikely to be fully aware of the dog's motivation at the time. Indeed, the very fact that the attack has happened at all makes it unlikely that the victim has an adequate appreciation of dog behavior (Luescher and Reisner, 2008). In clinical cases, many owners report that aggression occurs 'out of the blue' or for 'no apparent reason', but examination of historical evidence generally indicates a trigger for the aggression based on fear of a particular stimulus learnt during previous negative experiences, or anxiety due to exposure to a novel

382 situation. Furthermore, owner reports of dog attacks often include descriptions of
383 ambivalent body-language performed by the dog after the attack, including indicators of
384 both fear and appeasement inconsistent with the "status-enhancing" hypothesis (Luescher
385 and Reisner 2008). Moreover, the "body-language" of dogs is not interpreted consistently,
386 and even those with considerable experience of dog behavior can misread their behavior
387 (Westgarth and Watkins, 2015) .

388 Furthermore Schilder et al. (2014) state that 'teaching a dog to accept humans as dominants'
389 cannot be achieved by reward-based training, but through socialization and 'clear and
390 consistent behavior by the owner' (the last of which we agree with - see Casey et al., 2007).
391 No indication is given by Schilder et al. (2014) as to whether any specific type of training
392 might be effective in reducing "dominant" tendencies, but the everyday reality is that
393 techniques based on physical punishment are widely employed to this supposed end
394 (Greenebaum, 2010). They do criticize the use of techniques such as "alpha-rolls", but only
395 on the grounds that they are dangerous to the human participant. Luescher and Reisner
396 (2008), by contrast, offer very specific advice on the use of clinically-validated reward-based
397 training in the treatment of conflict-related aggression.

398 We are unclear as to how the arguments made by Schilder et al (2014) regarding 'dominance'
399 as a personality trait relate to their recommendations for avoiding 'dominance' in human -
400 dog interactions. Their suggestion for 'clear and consistent behavior by the owner' involving
401 reward based training is similar to the advice given widely by those involved in clinical
402 behavior and training, without reference to dominance. It is not clear whether these authors
403 would suggest additional interventions for those dogs described as having a 'dominant'
404 characteristic where owners have control problems, or what these may be, although the need
405 for such interventions is implied.

406 However, we agree completely with Schilder et al (2014) that the use of coercive methods
407 such as 'alpha rolls', widely used to assert 'dominance' over dogs (Greenebaum, 2010) are
408 entirely counter-productive. In addition to their concerns regarding owner safety, we would
409 emphasize the negative impact of using such techniques on the welfare of dogs (Rooney and
410 Bradshaw, 2014), and the association of such methods with a range of undesired behaviors
411 (Blackwell et al., 2008).

412

413 Conclusions

414 Although the conclusions arrived at by Schilder et al. (2014) are very different from those of
415 our earlier paper (Bradshaw et al., 2009), we do appear to be in agreement that the term

'dominance' is a valuable tool for ethologists, as the best method for summarizing agonistic relationships between (largely free-living) animals. However, because companion dogs occasionally appear to form unidirectional hierarchical relationships, but often do not, we here argue that the concept of 'dominance' is overly simplistic for this species, since it ignores much of the complexity of their social interactions. Instead, we believe that the principles of associative learning provide not only a more parsimonious but also a more complete explanation for relationships between companion dogs, influenced by each dog's specific experience of the other across time and context, and also their cumulative experience of previous encounters with other similar individuals. We agree with Schilder et al. (2014) that personality is an important contributor to dyadic relationships, but we consider that the personality characteristics of the two dogs, such as 'Motivation' (Ley et al. 2009), are no more than a starting point for the formation of their relationship, subsequently interacting with other factors, such as prior learning and physiological influences (e.g. fluctuation in reproductive hormones) in determining how two individuals behave towards one another. Furthermore, while there is still no absolute consensus as to how the personalities of dogs should best be characterized, recent studies have failed to identify "dominance" as a meaningful dimension. Moreover, the current consensus among ethologists (Petherick, 2010) is to restrict the term "dominance" to the description of relationships. Therefore, we regard it as both misleading and inaccurate to use the word "dominant" to describe the personalities of individual dogs.

Similarly, whilst it is clear that dogs have retained many of the individual patterns of intraspecific communicative behavior from the wolf, we urge caution in extrapolating the function of these behaviors from free-ranging dogs, or indeed wolves, to the behavior of companion dogs, for two reasons. Not only has the significance of the various displays almost certainly been altered during the process of domestication, but also the lifetime experiences of companion dogs are very different from those of their free-ranging counterparts. We particularly urge against the extrapolation of conclusions drawn from the intraspecific behavior of free-ranging dogs to the interpretation of interspecific behavior directed by companion dogs towards humans. Put simply, we do not believe that the fact that human observers can measure consistent relationships between some pairs of dogs, and can define these as dominance relationships, should be interpreted as providing evidence for the hypothesis that 'dominance' is an inherent ('personality') characteristic of dogs, nor that their behaviors are driven by the motivation to enhance their relative 'status'. Indeed, we argue that at our current state of knowledge of cognitive processes in the Carnivora, it is misleading to presume that domestic dogs have the mental capacity to conceptualize "status".

We also consider it dangerous to use such extrapolations to support techniques used to alter the behavior of companion dogs, whether that be basic training or the resolution of behavioral disorders. The "dominance" concept has long been used to justify the application of pain and fear in dog training, but it is becoming increasingly apparent that not only are such methods potentially dangerous for the person using them, they are counterproductive in terms of behavioral outcomes, owner-pet bonds, and canine welfare (Rooney and Bradshaw, 2014; Schalke et al., 2007; Schilder and van der Borg, 2004).

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Conflicts of interest

John Bradshaw is an independent academic and has no conflicts of interest relevant to this paper over the past 3 years. Rachel Casey and Emily Blackwell are employees of the University of Bristol and have no conflicts of interest to declare.

Ethical statement

This commentary does not report any original experimental research.

Authorship statement

All authors contributed equally to conceiving and writing the manuscript. No original research is reported.

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